

PHYS ED

The 4-Second Workout

Intense bursts of exercise throughout the day may have surprising metabolic benefits.



By **Gretchen Reynolds**

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Four seconds of high-intensity exertion repeated periodically throughout the day might counteract some of the unhealthy metabolic consequences of sitting for hours, according to a surprising and timely new study of the potentially large benefits of diminutive workouts.

The study relied on a specialized type of stationary bicycle that few of us will have available at home, but its implications remain broadly applicable and suggest that even a few minutes — or seconds — of exercise each day could help substantially to bolster our health.

For most of us, sitting is our default posture and was, even before the shelter-at-home edicts took effect across the globe. Epidemiological studies indicate that most American adults sit for a least 10 hours a day, a total that is likely to have risen now that many of us are home all day.

The health impacts of this inactivity can be considerable, with studies linking prolonged sitting to increased risks for heart disease, Type 2 diabetes and other metabolic disruptions. In particular, multiple hours of sitting can contribute to a later rise in the bloodstream of fatty acids, known as triglycerides, probably in part because muscles at rest produce less than contracting muscles do of a substance that breaks up triglycerides. High levels of triglycerides, in turn, are linked to an increased risk of heart disease and other metabolic problems.

In theory, exercise should help to combat this problem, since it entails muscular contractions. But some past experiments hint that a single workout may not be enough. In studies conducted at the University of Texas at Austin in recent years, healthy young people who sat

all day for the sake of science showed higher-than-normal levels of triglycerides in their blood the next day after a fatty meal. The sitting had left their metabolisms less able to break up and clear away the fat.

Even when the young people interrupted another full day of sitting with a one-hour run, they continued to experience difficulties with fat metabolism the next day. The researchers speculated that the long hours of sitting might have changed the volunteers' physiologies in ways that rendered them "resistant" to the expected, beneficial metabolic effects of physical activity.

Those studies had deployed a single moderately paced workout, however. Recently, the researchers began to wonder whether more-frequent, brief spurts of exercise throughout the day, especially if they were intense, might better stave off the undesirable effects of sitting.

So, for the new study, which was published in April in *Medicine & Science in Sports & Exercise*, the Texas scientists recruited eight healthy young men and women and asked them to spend a full day at the lab seated, rising only to eat or visit the bathroom. The next morning, the volunteers returned to the lab for a high-fat breakfast of melted ice cream and half and half, while the scientists monitored their bodies' metabolic response during the next six hours.

Then, on a separate day, the volunteers sat again, except for a few seconds each hour, when they sprinted.

These sprints took place on an unusual type of stationary bicycle with a heavy flywheel and no resistance that has been used at the U.T. physiology lab to test the leg and lung power of professional athletes. In those tests, athletes generated a tsunami of power and achieved all-out exertion within about two seconds of pedaling.

The scientists reasoned that if athletes needed two seconds of pedaling to reach maximum exertion, the rest of us probably would require, say, twice as much. So, they asked their volunteers to clamber on the bikes and sprint as hard as possible for four seconds, then stop pedaling, rest for 45 seconds, and sprint again, repeating that sequence five times.

The volunteers completed these brief interval sessions once every hour for eight hours, for a total of 160 seconds of actual exercise that day. Otherwise they sat, then returned the next day to down the unctuous breakfast shake.

Their metabolic responses differed this time, though, the researchers found. The volunteers

arrived at the lab with lower blood levels of triglycerides to start with and burned more fat during the next six hours, so their triglycerides remained about 30 percent lower throughout the six hours of monitoring than on the morning after nonstop sitting.

The results suggest that breaking up sitting with frequent, intense and extremely abbreviated exercise “can undo” some of the adverse effects of being sedentary, says Ed Coyle, a professor of kinesiology and health education at the University of Texas, who conducted the study with his graduate student Anthony Wolfe and others. (Dr. Coyle has equity in the company that manufactures the bicycles at his lab but said his stake did not influence the design of the study or reporting of results.)

This was a small, short-term study, of course, and its results are limited. They do not tell us if the desirable metabolic outcomes after sprinting linger past the next day or whether four-second intervals represent the right dose of exercise or merely the teensiest. The study also relied on an uncommon type of bicycle. Standard stationary bicycles or spin-class versions would likely require us to sprint for more than four seconds to reach an all-out exertion level, Dr. Coyle says. So would racing up and down stairs or jogging in place.

But the underlying theory of the study remains appealing and achievable, he adds. When you find yourself sitting for most of the day, try to rise frequently and move, preferably intensely, as often during the day as possible and for as many seconds as you can manage.

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